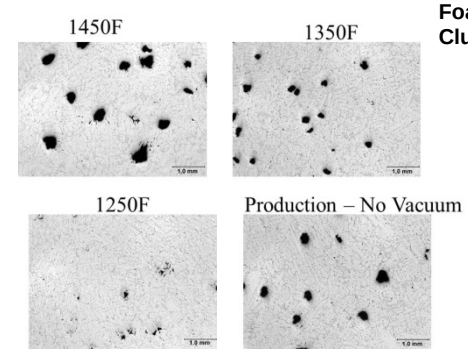
METALCASTING

E-SMARRT

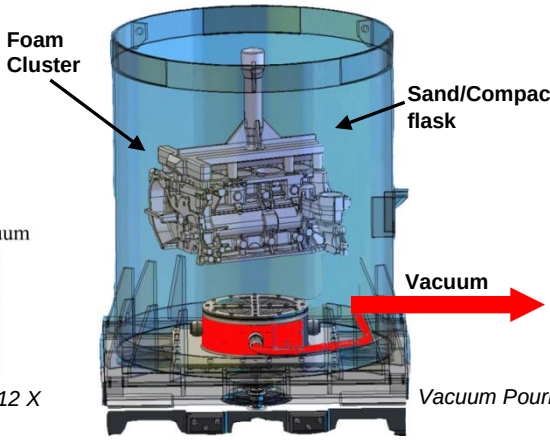
Energy-Saving Melting and Revert Reduction Technology

Improvements in the Lost Foam Casting Process

Problem: The aluminum casting process may produce components with lower mechanical properties than other forming processes, such as forging and machining, due to porosity formed by the release of hydrogen during solidification. The Lost Foam Casting Process (LFCP), a type of evaporative-pattern casting process that is advantageous for very complex castings, can produce additional porosity and folds when there is inefficient removal of gas formed during the degradation of the foam pattern. Process improvements were needed to increase mechanical properties while reducing porosity and the incidence of folds.



Typical Porosity from Main Bearing Blanks – 12 X



Vacuum Pouring Schematic

Engine Bed Plate Cast Using Vacuum Assisted Pouring

Casting *Pattern*

SUCCESS STORY

Solution: The University of Alabama at Birmingham (UAB), partnering with the Cast Metals Coalition on the E-SMARRT program, incorporated the Vacuum Assisted Pouring (VAP) process into the aluminum LFCP. VAP reduces porosity by allowing significantly lower pouring temperatures where the hydrogen content of the molten metal is reduced. VAP also provides a more uniform pressure gradient of the casting and allows for a more timely removal of gases from the casting cavity. This timing is critical in the removal of all gases before solidification.

Benefits: Casting trials at UAB using VAP have illustrated that metal porosity and the incidence of folds can be significantly reduced in automotive engine blocks using A319 and A356 aluminum. Porosity values in the main bearing areas of A319 engine blocks were reduced from 2.0 % to less than 0.5 %. In addition, ductility (% elongation) increased from 0.8 % to 1.5%. Increased ductility is an indicator of improved fatigue strength. Similar results were obtained for samples removed from an engine block poured using A356. Energy saving calculations indicate that the 200°F reduction in pouring temperature for aluminum alloys will reduce manufacturing energy usage by 17-29%.

"We are taking advantage of the Vacuum Assisted Pouring to reduce our gas consumption of the melting furnaces pouring at a lower pour temp resulting in ~ 6% savings in natural gas".

Tom McMahon
Senior Lost Foam Process Engineer,
Nemak

SCRA Applied R&D

nemak

AFS AND THE INSTITUTE

UAB

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